

Outcomes of Patients With COPD Undergoing Cardiac Surgery:

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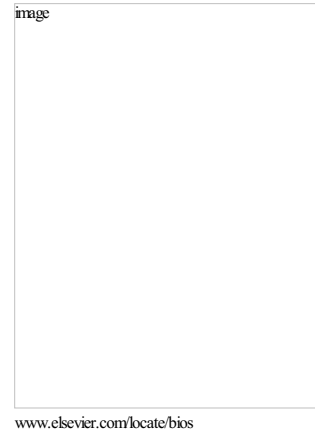
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Type of contribution: Invited Editorial

Title: Outcomes of Patients with COPD Undergoing Cardiac Surgery - Don't hold your breath

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The presence of chronic lung conditions such as chronic obstructive pulmonary disease have long been demonstrated to increase operative risk, particularly for those patients undergoing cardiac surgery. Several retrospective studies have demonstrated an association between obstruction and chronic obstructive pulmonary disease (COPD) with increased risk of mortality both in the short term and long term.¹⁻⁶

In this issue of the *Journal of Cardiothoracic and Vascular Anesthesia*, Ponomarev and colleagues⁷ present a study looking at 1-year outcomes of patients with pre-existing COPD or newly diagnosed obstruction on pulmonary function testing who are undergoing elective coronary artery bypass grafting. This is a follow-up study of a previously published cohort of prospectively enrolled patients that demonstrated a relationship between abnormal respiratory patterns (either restrictive or obstructive) and increased length of hospital stay, but not mortality.⁸ Not surprisingly now the authors find that patients with either COPD or newly diagnosed obstruction have an increased risk of mortality at 1 year. This adds little to the pre-existing understanding of the effect of chronic lung disease to operative risk, with much fewer patients than a previously published prospective study testing the same hypothesis.⁴ It does demonstrate reproducibility and robustness of a concept that is well accepted.

Although the concept of obstruction altering a patient's risk of survival post-cardiac surgery is important, this particular study's results should be interpreted with caution. This study had much fewer patients than previously reported studies. In addition, the authors combine obstruction and COPD as a composite group in order to demonstrate a statistically significant effect on mortality in a multivariable model. Obstruction alone was not shown to be an independent risk for mortality. This probably reflects the fact that the number of patients in this study was very small. Finally, the model was not externally validated on a separate population and therefore it is difficult to determine its significance. Given the small size of

this study it is difficult to delineate patient factors that would be important in determining if all patients with chronic lung disease were at a higher risk or if there was a select subpopulation of patients where the risks of surgery would perhaps outweigh the benefits.

Perioperative factors that could potentially affect outcomes in this cohort of cardiac surgical patients include: injurious mechanical ventilation and right ventricular (RV) injury, both shown to be independently associated with adverse clinical outcomes.^{9, 10} Data relating to perioperative ventilatory strategy and/or postoperative pulmonary compliance in the patient population studied by Ponomarev et al⁷ is not provided and therefore it is unknown whether these patients had ventilator induced lung injury (VILI) which would further exacerbate pulmonary morbidity and mortality. Patients with COPD commonly have different pulmonary mechanics (dynamic hyperinflation, higher PEEP requirements) compared with patients without pre-existing lung pathology. In the absence of prospective intraoperative ventilation data in cardiac surgical patients with airflow limitation, a low tidal volume (less than 6ml/kg predicted body weight) and low dynamic stress (avoidance of an increase in driving pressure above 13 cmH₂O) approach would seem reasonable.^{11, 12} None of the retrospective studies¹⁻⁷ examining the influence of COPD on postoperative mortality assess perioperative RV function or temporal changes in RV function. In a cohort study of COPD patients who required hospital admission for COPD exacerbation, RV dilatation and pulmonary hypertension on echocardiography was evident in 30% and 19% of patients respectively.¹³ Baseline echocardiography is paramount and right heart catheterization may be necessary to assess degree of pulmonary hypertension, optimize pharmacotherapy and risk stratify these patients preoperatively. Currently, there is no evidence-based recommendation for RV-protective ventilatory strategies in COPD patients since most of these patients have chronic hypercapnia and hypoxemia and therefore it is unknown whether they would benefit from acute reduction in arterial carbon dioxide partial pressure ($P_aCO_2 < 48\text{mmHg}$) or an

increased ratio of arterial oxygen partial pressure to fractional inspired oxygen ($P_aO_2/F_iO_2 > 150\text{mmHg}$) shown to be beneficial in patients with acute respiratory distress syndrome and RV dysfunction.^{14, 15}

COPD patients undergoing cardiac surgery are at a higher operative risk for morbidity and mortality. Although it is not possible to fully reverse airflow limitation and organ dysfunction in COPD, meticulous preoperative screening and work up with particular emphasis on pulmonary rehabilitation and adherence to inhaled agents may confer mortality benefit; however this requires further study. A recently completed randomized controlled trial examined the effect of prophylactic use of high-flow nasal oxygen on patient-centered outcomes, in cardiac surgical patients with pre-existing lung disease.¹⁶ Publication of the results is awaited with interest as if 'positive' it could potentially advance clinical practice in the new era of 'personalized medicine'.

References

1. McAllister DA, Wild SH, MacLay JD, et al. Forced expiratory volume in one second predicts length of stay and in-hospital mortality in patients undergoing cardiac surgery: a retrospective cohort study. *PLoS One* 2013;8(5):e64565.
2. O'Boyle F, Mediratta N, Chalmers J, et al. Long-term survival of patients with pulmonary disease undergoing coronary artery bypass surgery. *Eur J Cardiothoracic Surg* 2013;43(4):697-703.
3. Ad N, Henry L, Halpin L, et al. The use of spirometry testing prior to cardiac surgery may impact the Society of Thoracic Surgeons risk prediction score: a prospective

study in a cohort of patients at high risk for chronic lung disease. *J Thorac Cardiovasc Surg* 2010;139(3):686-691.

4. Adabag AS, Wassif HS, Rice K, et al. Preoperative pulmonary function and mortality after cardiac surgery. *Am Heart J* 2010;159(4):691-697.
5. Saleh HZ, Mohan K, Shaw M, et al. Impact of chronic obstructive pulmonary disease severity on surgical outcomes in patients undergoing non-emergent coronary artery bypass grafting. *Eur J Cardiothorac Surg* 2012;42(1):108-13; discussion 113.
6. Leavitt BJ, Ross CS, Spence B, et al. Long-term survival of patients with chronic obstructive pulmonary disease undergoing coronary artery bypass surgery. *Circulation* 2006;114(SUPPL. 1):430-435.
7. Ponomarev D, Kamenskaya O, Klinkova A, et al. Chronic lung disease and mortality after cardiac surgery: a prospective cohort study. *J Cardiothorac Vasc Anesth* 2018 (In press).
8. Ponomarev D, Kamenskaya O, Klinkova A, et al. Prevalence and Implications of Abnormal Respiratory Patterns in Cardiac Surgery: A Prospective Cohort Study. *J Cardiothorac Vasc Anesth*. 2017;31(6):2010-2016.
9. Lellouche F, Dionne S, Simard S, Bussi res J, Dagenais F. High tidal volumes in mechanically ventilated patients increase organ dysfunction after cardiac surgery. *Anesthesiology*. 2012;116(5):1072-82.
10. Bootsma IT, de Lange F, Koopmans M, et al. Right Ventricular Function After Cardiac Surgery Is a Strong Independent Predictor for Long-Term Mortality. *J Cardiothorac Vasc Anesth*. 2017;31(5):1656-1662.

11. Marini JJ. Ventilator-associated problems related to obstructive lung disease. *Respir Care*. 2013;58(6):938-49.
12. Neto AS, Hemmes SN, Barbas CS, et al. Association between driving pressure and development of postoperative pulmonary complications in patients undergoing mechanical ventilation for general anaesthesia: a meta-analysis of individual patient data. *Lancet Respir Med*. 2016;4(4):272-80.
13. Freixa X, Portillo K, Paré C, et al. Echocardiographic abnormalities in patients with COPD at their first hospital admission. *Eur Respir J*. 2013;41(4):784-91.
14. Mekontso Dessap A, Boissier F, Charron C, et al. Acute cor pulmonale during protective ventilation for acute respiratory distress syndrome: prevalence, predictors, and clinical impact. *Intensive Care Med*. 2016;42(5):862-870.
15. Repessé X, Charron C, Vieillard-Baron A. Acute cor pulmonale in ARDS: rationale for protecting the right ventricle. *Chest*. 2015;147(1):259-265.
16. ClinicalTrials.gov [Internet]. Bethesda (MD): National Library of Medicine (US). 2000 Feb 29 - Identifier NCT02496923 High-Flow Nasal Oxygen (Optiflow™) in High-Risk Cardiac Surgical Patients, 2015 June 22 [cited 2015 July 14]. Available from: <https://clinicaltrials.gov/ct2/show/NCT02496923?term=NCT02496923&rank=1>